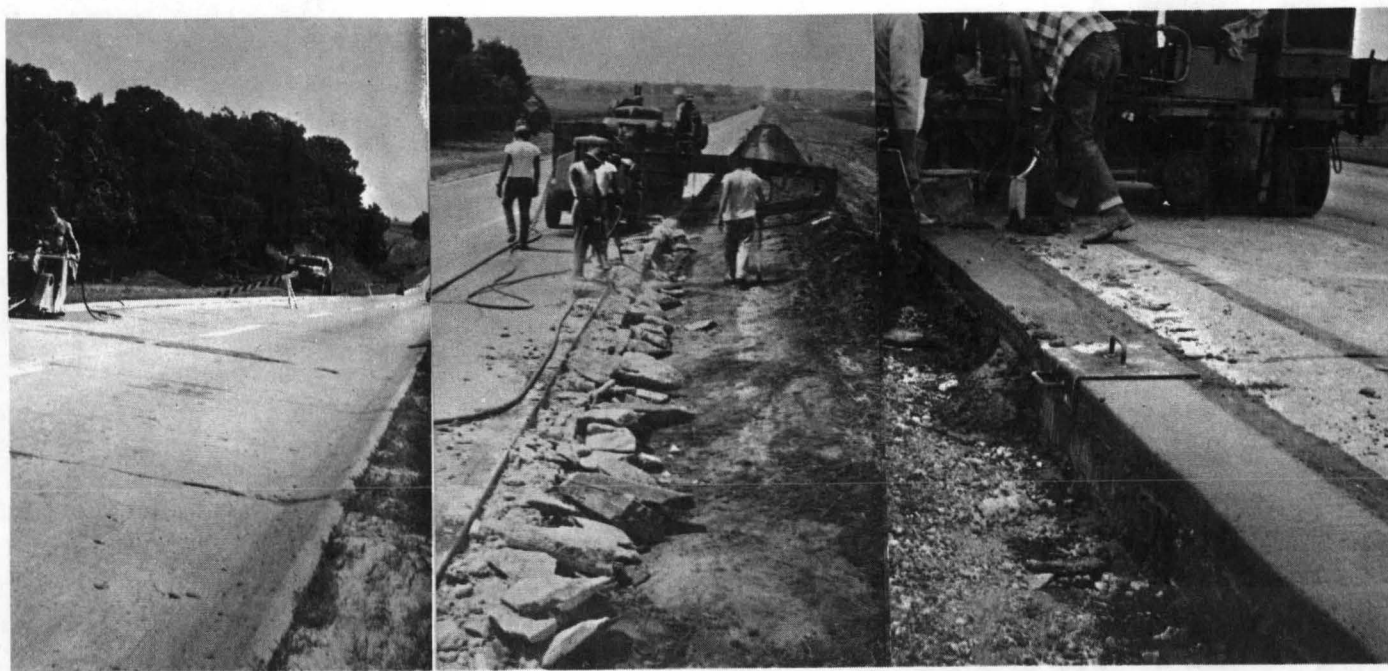


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PROGRESS REPORT

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CURB REMOVAL STUDY

RESEARCH DEPARTMENT
IOWA STATE HIGHWAY COMMISSION
JANUARY 1962

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PROGRESS REPORT

IOWA HIGHWAY RESEARCH BOARD PROJECT HR-76

CURB REMOVAL STUDY

RESEARCH DEPARTMENT

IOWA STATE HIGHWAY COMMISSION

JANUARY, 1962

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THE PROBLEM

Pavements constructed in Iowa during the period of the 1920's through the late 1940's were built with an integral curb. The purpose of the curb was to control drainage of water from the pavement surface in areas where runoff took place at a very rapid rate. It is for this reason that curbing is found on pavements constructed during this period. The curbing led the water flowing on the pavement surface to drainage outlets; this helped reduce erosion along the edge of the slab. The curbs have satisfactorily performed the job for which they were intended.

The advent of bigger and faster vehicles has created a demand for changes in the design of pavements. Current designs provide wider driving surfaces with reduced grades which can better accommodate the wider cars and trucks.

By present day design standards the narrow highways are inadequate and are being replaced or improved. The normal improvement procedure is to widen to 24 feet by providing additional driving surface at each edge of the pavement. Curbing is removed from the pavement so that the surface of the widening can be placed at the same level as that of the slab.

On January 1, 1961, there were 1,620 miles of 18-foot pavement on the Primary system. Most of these roads will be widened as soon as funds are available. Some of the 18-foot roads cannot be upgraded to modern standards simply by widening. Extensive reconstruction and relocation are necessary in many instances to correct for poor alinement and inadequate sight distance.

P R O P O S E D S O L U T I O N

An emergency measure is being considered for improving 18-foot pavements pending widening and reconstruction. This method consists of removing the curb from 18-foot pavements and restoring the area formerly occupied by the curb. Four pilot projects (Table I) were constructed in an effort to evaluate the practicability of this method. The objectives of this study are:

1. To compare various methods of removing curbing and converting that area to a driving surface.
2. To compare costs of the different methods of curb removal and replacement.
3. To determine the possible effects of this method upon placement and performance of any future widening projects.

TABLE I

CURB REMOVAL PROJECTS

COUNTY & ROAD NUMBER	Dallas Iowa 64	Polk Iowa 64	Jasper Iowa 64	Story U. S. 30
PROJECT NUMBER	FN-751	FN-215	FN-376	FN-917
CONTRACTOR	Hallett Construction Company	Hallett Construction Company	Hallett Construction Company	Jackson Construction Company
PROJECT LENGTH, MILES	7.587	0.715	8.262	2.946
CURBED LENGTH, LINEAR FEET	28,758.6	7,553.9	72,492.0	18,367.0
METHOD (See Table II)	Method #1 #2 #3	Method #1	Method #1 #2 #3	Method #1 #4

NOTE: See tabulation of bids and final costs, Appendix A.

CONSTRUCTION AND MATERIALS

METHODS

The projects listed in Table I were constructed according to the provisions of supplemental specifications #462 of May 9, 1961, (See Appendix B). The method of removing the curb was identical for all four projects. Four different methods were specified for filling in the broken surface caused by removing the curb. These methods consist of backfilling to the surface of the slab using the combinations of materials indicated in Table II. Two or more methods were used on each project with the exception of the Polk County project which consisted of method #1 only.

TABLE II

METHODS OF CONSTRUCTION

METHOD	FILLER MATERIAL	BONDING AGENT
#1	Standard P. C. Concrete	Sand-Cement Grout
#2	Standard P. C. Concrete	Epoxy Resin Grout
#3	Latex Modified Concrete	Latex Modified Grout
#4	Type A Asphaltic Concrete	RC-O Tack Coat

MATERIALS

Standard P.C. concrete was used as filler material for both method #1 and #2 (See Appendix B). The rough surface remaining after the curb was removed received an application of pre-mixed sand-cement grout in method #1.

In method #2, an epoxy adhesive was used to bond the standard P.C. concrete to the area from which the curb had been removed.

Method #3 used latex modified concrete, a P.C. concrete mix with a synthetic latex emulsion admixture, as the filler material. Some of the latex modified concrete was broomed onto the broken surface to serve as a grout.

Type A asphaltic concrete with a mixture size designation of $\frac{1}{2}$ inch was used in method #4. The asphaltic concrete was produced by Land Construction Company who had a plant set up in Des Moines, Iowa and was doing highway work at the time. The material was delivered to the job site in trucks.

A TYPICAL PROJECT

The Jasper County curb removal project was selected as a typical project in order that estimates of personnel and equipment requirements might be obtained.

Hallett Construction Company had completed the Dallas and Polk County curb removal projects prior to starting work on the Jasper project. It was assumed that the data obtained would be more representative of normal construction conditions since the contractor had had a chance to perfect his equipment and procedure on the two previous projects.

CONSTRUCTION OPERATIONS

Construction of the Jasper County project was carried out in the following manner:

The first operation consisted of making a saw cut $1\frac{1}{2}$ inches in depth within $\frac{1}{2}$ inch of the toe of the curb. This saw cut was not vertical but undercut the pavement surface approximately $\frac{1}{8}$ of an inch. The concrete of the slab on this project contains a gravel coarse aggregate which is more difficult to saw and break than a concrete which contains a limestone coarse aggregate.

The shoulder was bladed away from the curb prior to the breaking operation in order to furnish the necessary working room required for manipulation of the curb breaking machine.

The saw cut was cleaned of any foreign matter by drawing a thin metal strip through it immediately before the curb was to be removed.

The curb was then knocked off by a curb breaking machine which consisted of a hydraulic-pneumatic ram which struck the curb from the shoulder side of the slab. Normally two air hammers were working in conjunction with the curb breaker. Two operators followed up with these air hammers to remove the high spots left by the curb breaker. Removal of flumes was coordinated with the curb breaking.

A cleanup crew followed the curb breaking operation. The broken curb was loaded into trucks by an end-loader and hauled to designated stockpile areas.

The paving operation consisted of the following steps:

1. Compressed air was used to clean the broken surface on the curb section.
2. The curb section was wetted down approximately one hour prior to paving.
3. A sand-cement grout was broomed onto the broken surface immediately ahead of the paver.
4. Standard P.C. concrete was placed on the curb section with a slip-form paver.
5. Hand finishers worked the concrete behind the paver.
6. Removable metal strips were placed in the plastic concrete to form contraction joints, and mastic strips were placed to form expansion joints. These joints were constructed so as to coincide with existing joints in the slab.
7. A continuous strip of plastic was placed over the finished concrete to aid curing.

The concrete filler material, which was mixed and transported to the job site in ready-mix transports, was placed on the curb section with a slip-form paver. This slip-form paver had been used to place concrete on some of the earlier widening projects and was modified for the curb filling operation (Photo #1).

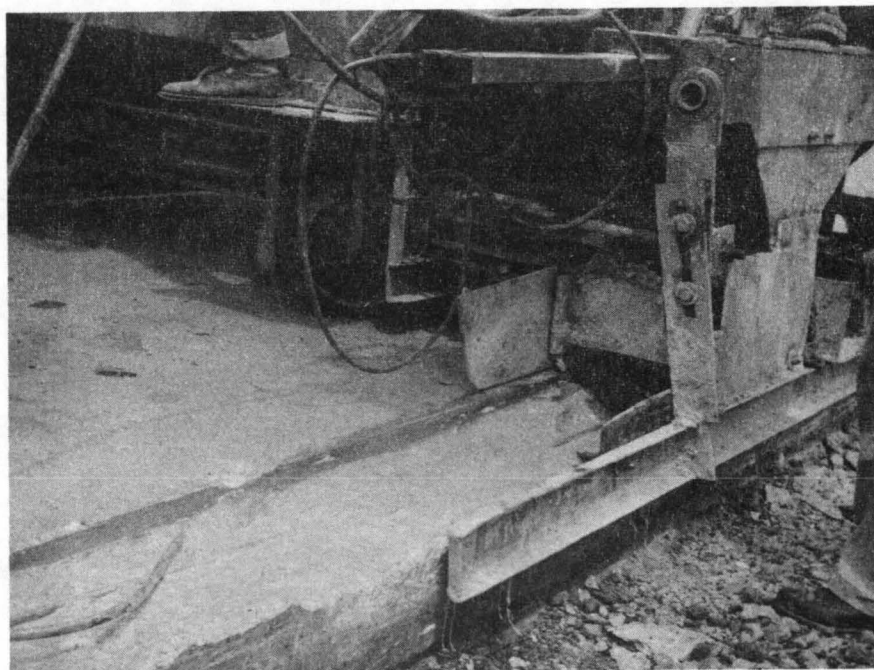


Photo #1 - Hallet Construction Company's paver which was modified to place curb filler material.

Concrete was dumped into the hopper of the paver and augered to the "slip-form". An electrically powered vibrator extended approximately one inch into the concrete on the curb section.

Moving "forms" or plates shaped the concrete to the desired cross-section both vertically at the edge and horizontally on the surface. The resulting surface was not satisfactory, and extensive hand finishing was required to correct the excess and deficiencies left by the paver.

Other incidental operations were: erection of barricades and placement of flares, recovering curing plastic which had been blown loose by traffic, and shouldering.

EQUIPMENT AND PERSONNEL

The following is a summary of the production rates and the personnel and equipment requirements obtained from a 12-day observation of operations. Time required for maintenance or lost during breakdowns is not accounted for separately. Only one method of curb replacement was used during this 12-day period; standard P.C. concrete with a sand-cement grout.

Sawing Operation (Photo #2 and #2A)

Equipment: 3 to 6 concrete saws with diamond blades
1 or 2 water trucks
1 pick-up truck

Personnel: 8 men (when 3 saws were in operation)

Production Rate: Approximately 64 feet per saw per hour, individual saws were timed at rates of from 1.3 fpm to 2.5 fpm

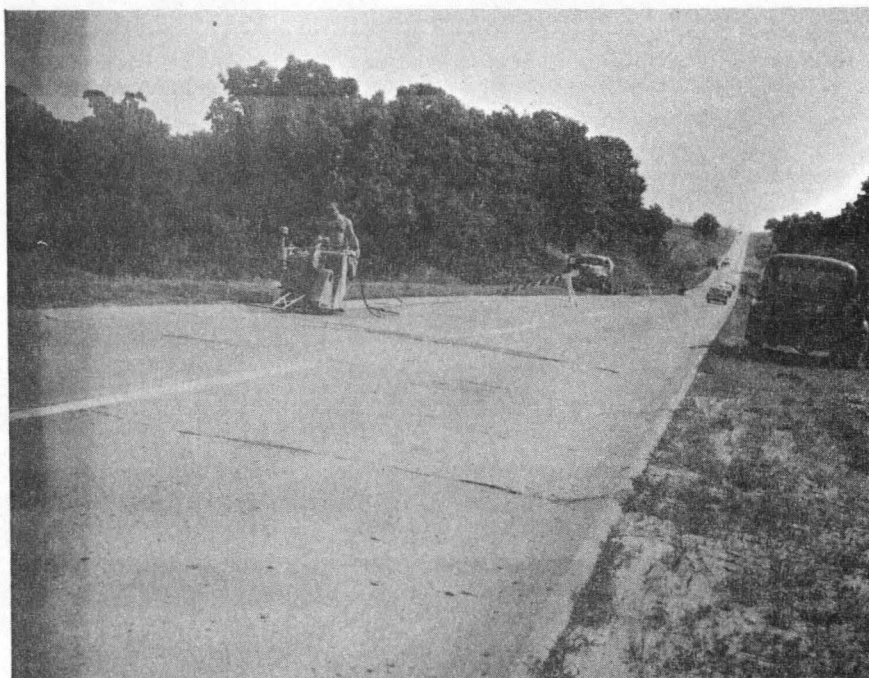


Photo #2 - Sawing operation.



Photo #2A - Concrete saw using a blade which has diamonds imbedded on the cutting edge.

Curb Breaking Operation (Photo #3)

Equipment: 1 curb breaking machine
2 air hammers
1 air compressor
1 road patrol (part time)

Personnel: 8 men

Production Rate: 352 feet per hour, curb breaker operated at a rate controlled by the progress of the air hammer operators' progress

Clean-Up Operation (Photo #4)

Equipment: 1 end-loader
2 or 3 trucks

Personnel: 6 men

Production Rate: Keeps up with the breaking operation

Paving Operation (Photo #5)

Equipment: 1 slip-form paver
1 water truck
1 "grouting" truck
1 or 2 air-compressors

Personnel: 17 men

Production Rate: Approximately 504 feet per hour; the paver was timed at rates of from 16 to 26 fpm. The paver had to operate intermittently because of the slowness of the sawing and breaking operations

Note: The supplemental specifications required that curbing could not be removed more than one day in advance of paving.



Photo #3 - Curb breaking machine knocking off the curb.
Air hammers used to remove high spots left
by curb breaker.



Photo #4 - Clean-up operation.

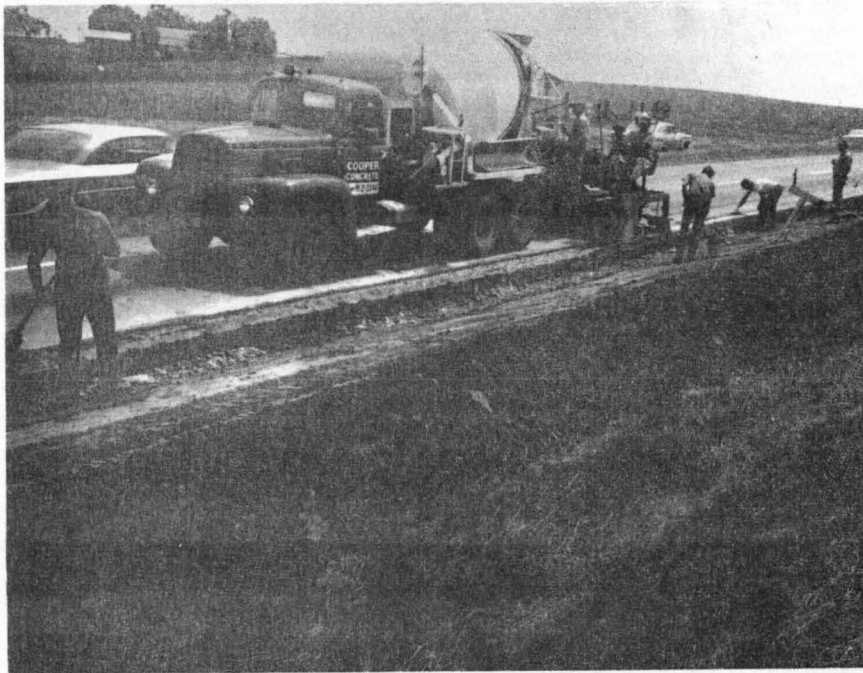


Photo #5 - Slip-form paver placing ready-mixed concrete on curb section.

Shouldering Operation

Equipment: 1 earth moving unit
1 or 2 road patrols

Personnel: 2 or 3 men

Production Rate: Not determined

Other miscellaneous equipment was required such as a low-boy trailer, a welder, etc.

C O M P A R I S O N O F D I F F E R E N T M E T H O D S

The following is a comparison of the four different methods

used to backfill the broken curb section up to the surface of the slab (See Table II, p. 4).

PROBLEMS OF CONSTRUCTION

Method #1

The biggest problem in placing the standard P.C. concrete with a slip-form paver was to obtain a satisfactory surface. Hand finishing was required in conjunction with both of the slip-form pavers; the one used by the Hallett Construction Company, and the one used by the Jackson Construction Company (Photo #6). This hand finishing was time consuming and did not completely correct for the inadequacies of the pavers. Finishers had to work rapidly in order to keep up with the paver. The resulting surface was not a tangent continuation of the surface of the slab, but had a tendency to slope downward toward the shoulder.

It was required by the specifications that the curb filler should not over hang the slab, that is, none of the curb filler material was to extend beyond the vertical edge of the slab. Neither paver was able to eliminate this overhang, so an additional hand operation of removing the overhanging material was required (Photo #7).

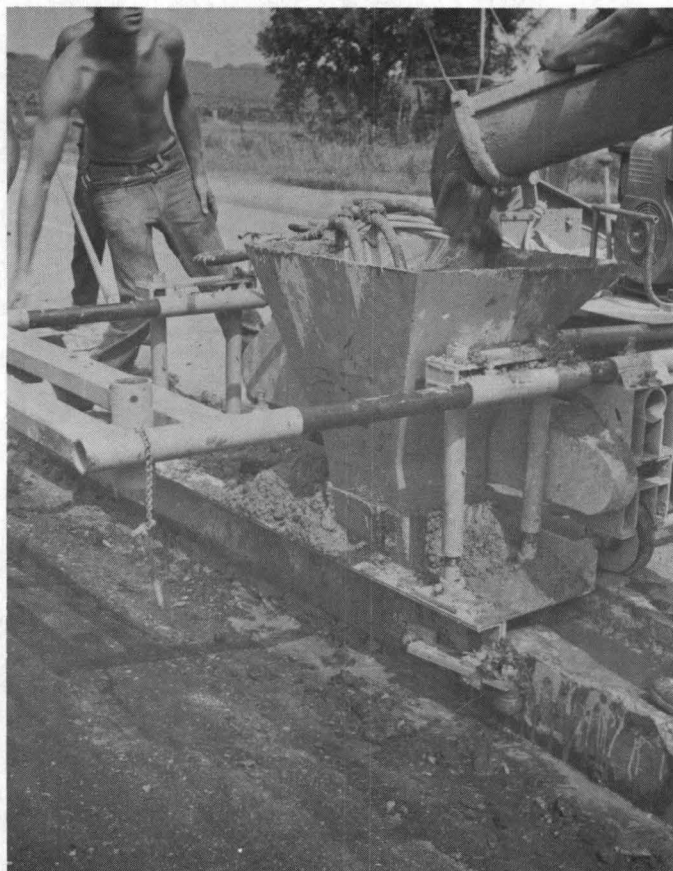


Photo #6 - Jackson Construction Company's slip-form paver.



Photo #7 - Removing overhanging P.C. concrete left by the slip-form paver.

Placement of removable metal strips for contraction joints and mastic strips for expansion joints caused the curb filler material to slump near the edge (Photo #8). The plastic concrete at these slumped sections was reshaped as near as possible to the desired cross-section by the finishers.

Method #2

The problems of placing standard P.C. concrete on an epoxy treated surface, with a slip-form paver, are the same as those of method #1. An additional problem with this method is the application of the epoxy grout to the broken surface. The epoxy was applied by pouring the epoxy from a can and spreading it with stiff bristle brushes (Photo #9). The consistency of the epoxy was such that much effort was required to obtain adequate coverage of the broken surface. Accumulated epoxy had to be cleaned from the brushes with a solvent at regular intervals. This method of treating the surface to receive the concrete is considerably slower than any of the other methods.

Method #3

Latex modified concrete was not placed with a slip-form paver. Wooden forms were placed along the edge of the slab to receive the latex modified concrete. Material was transported from the mixer to the forms in wheelbarrows.

The tendency of the latex modified concrete to adhere to

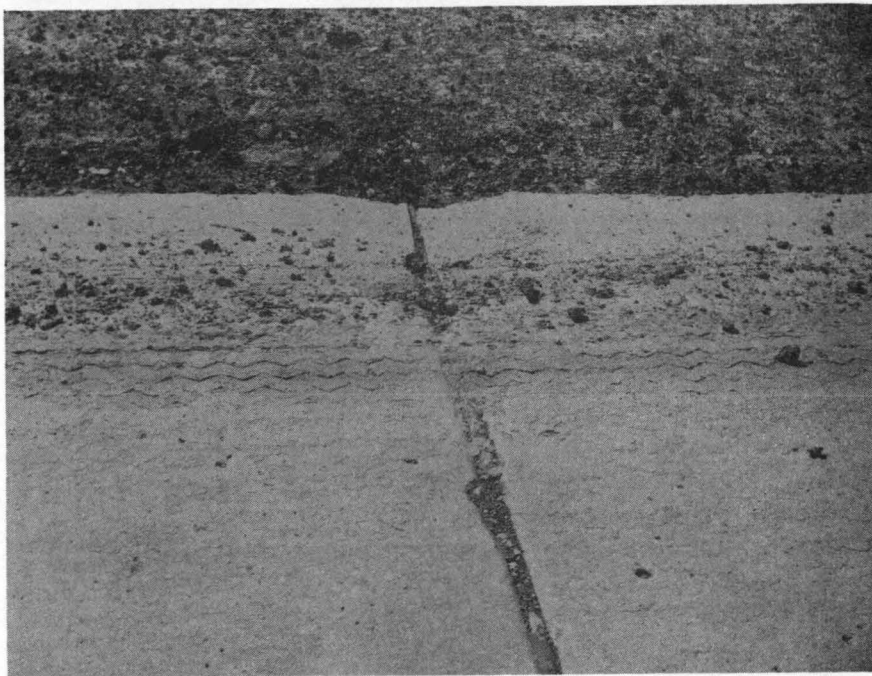


Photo #8 - Slumping of concrete filler material at a joint.



Photo #9 - Placing epoxy adhesive on the rough surface of the curb section.

everything makes the use of a slip-form paver impractical. Due to the resilient nature of this material, a vibrator is not effective over a very large area unless the latex modified concrete is of a nearly fluid consistency.

Batching and mixing of latex modified concrete requires closer scrutiny than that required for any of the other materials used (Photo #10).



Photo #10 - Placing latex modified concrete. Note that LMC was broomed onto surface to serve as a grout.

Method #4

Lack of lateral support at the outer edge of the curb section caused difficulty in compacting the asphaltic concrete filler material. The asphaltic concrete tended to squeeze out over the edge of the slab during rolling operations (Photo #11 and #12).

The asphaltic concrete test section was constructed in part on different days. One-half of the length of the test section was overfilled and compacted with a steel roller on the first day. Overfilling was necessary to allow for loss of material that squeezed over the edge of the slab. On the second day the remaining curb section was filled to within $\frac{1}{2}$ inch of the slab surface and compacted by running a truck wheel over the asphaltic concrete. Again the curb section was overfilled and compacted with a steel roller. The amount of material wasted was reduced by the operation used on the second day.

PERFORMANCE OF DIFFERENT METHODS

None of these projects have been in service through an entire winter. Preliminary observations are as follows:

Method #1

At the end of approximately six months of service the sections constructed with standard P.C. concrete on a sand-



Photo #11 - Asphaltic concrete pushed beyond edge of slab by action of ~~slab~~ roller.



Photo #12 - "Overfilling" with asphaltic concrete to compensate for material forced beyond edge of roller.

cement grout are adequately bonded to the curb section. Reflection cracking of the filler material is evident.

Method #2

After approximately six months of service the sections constructed with standard P.C. concrete on an epoxy treated surface are adequately bonded to the curb section. Reflection cracking of the filler material is evident.

Method #3

After approximately six months of service the sections constructed with latex modified concrete are adequately bonded to the curb section. Reflection cracking of the filler material is evident.

Method #4

At the end of approximately three months of service the section constructed with asphaltic concrete is adequately bonded to the curb section. The surface of this curb filler has been lowered to a level slightly below the slab surface by the action of traffic (Photo #13).



Photo #13 - Effects of traffic on the asphaltic concrete filled curb section.

COMPARATIVE COSTS

TABLE III
COST OF FURNISHING AND PLACING
FILLER MATERIAL

METHOD	NUMBER OF STATIONS	TOTAL COST	COST PER STATION
#1 Standard P.C. Concrete With Sand-Cement Grout	1,222.745	\$50,959.07	\$ 41.68
#2 Standard P.C. Concrete With Epoxy Grout	19.900	1,990.00	100.00
#3 Latex Modified Concrete	19.690	2,953.50	150.00
#4 Type A Asphaltic Concrete	9.380	703.50	75.00

NOTE: See tabulation of final costs, Appendix A.

Comparison of the actual costs of the four different methods may not be realistic since these projects were of a research nature. The cost of these methods would most likely vary considerably from the present values if this type of construction were used on a large scale.

MAINTENANCE

Maintenance problems are created by removing the curb from an 18-foot pavement. Presence of the curb kept truck wheels from

traveling on the shoulder in the past. Edge rutting has resulted from the action of trucks traveling with their outside tires on the shoulder in the areas where curbs have been removed. Additional expenditures are required to repair this edge rutting damage.

Snow removal operations in these same areas will be made easier now that the plows will not have to contend with the curbs.

Complete contracts for the curb removal projects included reshaping of shoulders and construction of ditches in cut-sections where no ditch existed initially. Small ditches, due to the narrow right-of-way on the pilot projects, are not adequate. Token ditches, constructed in cut-sections to drain water away from the slab, will add to the Maintenance Department's problems.

FUTURE WIDENING

The curb removal and replacement described in this report should not have any physical effect on possible future widening of these same sections of highway. The important effect is an economic one.

The usual widening contract includes an item for curb removal. The rough area caused by breaking the curb is repaired

coincident with placing the two or three foot widening. If the curb removal and replacement are accomplished the first year, and the widening is placed sometime thereafter on a separate contract, there is some duplication of effort, and additional cost will be encountered.

It may be assumed that for the two contract curb removal and widening operation the contractor's move in and organizational costs will be duplicated, together with some of his labor expense and equipment rental. There will also be a duplication of shoulder finishing and the cost thereof. It is reasonable to expect a premium to be paid for the closer tolerance on curb removal. The added cost due to a two contract operation has been estimated as follows:

Assume one mile of road curbed both sides.

a.	Move in and organization cost based on \$2,000, for a 10 mile project.	\$ 200.
b.	Labor and equipment rental at \$0.125 per foot, one side	1,320.
c.	Closer tolerance on curb removal at \$0.05 per foot	528.
d.	Shoulder finishing at \$10.00 per station	<u>528.</u>
	Total (Per Mile)	<u>\$2,576.</u>

The above estimate does not include the additional cost of material for the two contract method. The same volume of con-

crete is required if the curb is replaced as a separate operation or in conjunction with the widening. The cost, however, would probably be greater if the materials must be supplied on two different occasions.

On many of our widening projects a limited amount of grade correction is made to improve sight distance. This involves complete removal of the old slab. Any curb removal and replacement that had been done in these areas would be junked and constitute a 100% loss. The amount of work that might constitute a 100% loss will vary from job to job and depend greatly upon the terrain, vintage of existing pavement, and the traffic volume of the road involved. Due to these many variables this factor was not considered in the estimated additional cost.

S A F E T Y

Curb removal and replacement involves a consideration of highway safety. Some drivers believe that curbs are hazardous, especially when the pavement is wet or ice coated. Others believe that curbs may actually be beneficial to safe driving by providing a positive indication of the position of the vehicle with reference to the edge of the pavement.

A five year study of accidents (1954-1958) at twenty-four primary highway locations, twelve areas having 18' paving with

curb and twelve having 18' paving without curb, produced similar results, - a very high accident rate per vehicle mile for low volume traffic areas. (See Appendix C for details.)

In each highway district two 18' sections with curbing and two 18' sections without curbing were selected. Sections used for comparison have similar traffic volumes, length of test section and sufficiency rating.

Accidents on the 18' paving with curbing totaled 363 for the twelve surveyed areas. Of these, 27, or 7.4 per cent, were directly or indirectly attributed to curbing and flumes.

Accidents on 18' paving without curbing totaled 317. Of these, 16, or 5.1 per cent, might possibly have been averted if curbs were present.

Accidents, occurring on 18' sections with curbing, indicate that the curbing was a contributing factor in causing the accidents, but it can only be assumed that accidents occurring on 18' sections without curbing might have been prevented by curbing. Drivers' loss of control on soft shoulders is the major cause listed, for accidents on 18' paving without curbs, that could possibly have been prevented if curbs were present. This assumption was made after reading the drivers' written accident reports.

Curbed sections on 18' paving are located in areas where

they are needed to carry drainage; thus the curbed sections are located in more hazardous, hilly terrain areas as compared to the less hazardous uncurbed flat terrain sections.

It appears doubtful that accident reports can furnish reliable proof for the safety value of either the presence or absence of curbing.

C O N C L U S I O N S

The following statements are based on construction experience and a very short period of service. Future service records may require modification of these preliminary conclusions.

1. Curb replacement may be successfully accomplished with all four of the material combinations described in this report.
2. Replacement with standard Portland cement concrete, following a sand-cement grout, is the least expensive of the four combinations.
3. If curb removal and replacement is contracted for separately, with subsequent widening, then the cost of this two contract operation will be greater than the cost of a single contract which combines curb removal and widening.

A C K N O W L E D G M E N T S

We wish to acknowledge the cooperation of all departments of the Iowa State Highway Commission for their part in the preliminary evaluation, design, and the actual construction of these curb removal projects.

A preliminary evaluation and suggested specifications were prepared by R. E. Merrill, Special Assignments Engineer.

T. E. McElherne, Materials Engineer, worked with the Specifications Committee in preparing the supplemental specification pertaining to materials and construction.

Construction of the pilot projects in Polk and Dallas Counties was under the supervision of L. R. Fletchall, Resident Construction Engineer.

Construction of the pilot projects in Jasper and Story Counties was under the supervision of G. C. George, Resident Construction Engineer (acting).

A. M. Hensing, Assistant Construction Engineer, gave assistance in solving problems of construction.

The accident study information was gathered by the Traffic and Highway Planning Department.

RECORD OF CONSTRUCTION AND MATERIAL BIDS
Iowa State Highway Commission

NAME OF CONTRACTOR				HALLETT CONS. CO.		CENTRAL CONS. CO.		W. W. SALES CO.	
CONTRACTOR'S ADDRESS				CROSBY, MINN. &					
AMOUNT OF BIDDER'S CHECK Req. Amt. \$2,000.00				BOONE, IA.		INDIANOLA IA.		AMES, IOWA	
No.	Item	Quantity	Unit	Unit Price	Amount	Unit Price	Amount	Unit Price	Amount
1	Class 10 excav rdwy & borrow	150.	cy	1.00	150.00	.35	52.50	1.75	262.50
2	Removal of curb	286.257	stas.	45.00	12,881.57	88.00	25,190.62	45.00	12,881.57
3	Removal of flumes	25.	only	45.00	1,125.00	34.00	850.00	50.00	1,250.00
4	Port. cem. conc. curb filler	266.457	stas.	45.00	11,990.57	67.00	17,852.62	78.50	20,916.87
5	Port. cem. conc. curb filler latex modified	9.9	stas.	150.00	1,485.00	200.00	1,980.00	100.00	990.00
6	Port. cem. conc. curb with epoxy bond	9.9	stas.	100.00	990.00	75.00	742.50	100.00	990.00
7	Shoulders	286.257	stas.	10.00	2,862.57	40.00	11,450.28	17.50	5,009.50
8	Driveway Surf. matl. Class A crushed stone	346.	tons	4.50	1,557.00	5.00	1,730.00	3.50	1,211.00
9	Expansion joints	292.	only	.60	175.20	1.25	365.00	1.00	292.00
	Total				33,216.91		60,213.52		43,803.44

- 30 -

A P P E N D I X A

RECORD OF CONSTRUCTION AND MATERIAL BIDS Iowa State Highway Commission

DATE OF LETTING: May 9, 1961 LOCATION: 7.587 miles on Iowa 64 from U.S. KIND OF WORK: Curb Removal
 STARTING DATE: 5-22-61 169 east to point near S $\frac{1}{4}$ Cor. PROJECT NO: FN-751 Widen
 COMPLETION DATE: 7-22-61 SE $\frac{1}{4}$ Sec 34-80-26 except through BID ORDER NO: 112
 Dallas Center COUNTY: Dallas(Cont.)

NAME OF CONTRACTOR CONTRACTOR'S ADDRESS AMOUNT OF BIDDER'S CHECK Req. Amt. \$2,000.00				JACKSON CONS. CO., INC. NEVADA, IA.		THE MARRIC CO. DES MOINES, IA.		YEGGE-BLOSSER CONS. CO. BOONE, IOWA	
No.	Item	Quantity	Unit	Unit Price	Amount	Unit Price	Amount	Unit Price	Amount
1	Class 10 excav rdwy & borrow	150.	cy	1.00	150.00	.50	75.00	1.00	150.00
2	Removal of curb	286.257	stas.	50.00	14,312.85	69.50	19,894.86	60.00	17,175.42
3	Removal of flumes	25.	only	50.00	1,250.00	40.00	1,000.00	40.00	1,000.00
4	Port. cem. conc. curb filler	266.457	stas.	62.00	16,520.33	68.50	18,252.30	75.00	19,984.28
5	Port.cem. conc. curb filler latex modified	9.9	stas.	112.00	1,108.80	231.00	2,286.90	100.00	990.00
6	Port. cem. conc. curb with epoxy bond	9.9	stas.	87.00	861.30	97.50	965.25	90.00	891.00
7	Shoulders	286.257	stas.	10.75	3,077.26	32.00	9,160.22	10.00	2,862.57
8	Driveway surf. matl. Class A crushed stone	346.	tons	4.00	1,384.00	3.35	1,159.10	4.00	1,384.00
9	Expansion joints	292.	only	1.00	292.00	1.00	292.00	.30	87.60
	Total				38,956.54		53,085.63		44,524.87

Combination Bid: Dallas County Curb Removal Project FN-751 and Polk County Curb Removal Project FN-215
 are tied. No other ties or reservations.

A P P E N D I X A

RECORD OF CONSTRUCTION AND MATERIAL BIDS Iowa State Highway Commission

DATE OF LETTING: May 9, 1961	LOCATION: On Iowa 64 from Polk County	KIND OF WORK: Curb Removal
STARTING DATE: 5-22-61	line northeast to Story County	PROJECT NO: FN-376 Widen
COMPLETION DATE: 7-22-61	line. 8.262 miles.	BID ORDER NO: 113
		COUNTY: Jasper

NAME OF CONTRACTOR CONTRACTOR'S ADDRESS AMOUNT OF BIDDER'S CHECK Req. Amt. \$4,000.00				HALLETT CONS. CO. CROSBY, MINN. & BOONE, IOWA		CENTRAL CONS. CO. INDIANOLA, IA.		JACKSON CONS.CO. INC. NEVADA, IA.	
No.	Item	Quantity	Unit	Unit Price	Amount	Unit Price	Amount	Unit Price	Amount
1	Class 10 excav rdwy & borrow	825.	cy	1.00	825.00	.35	288.75	.75	618.75
2	Removal of curb	734.546	stas.	45.00	33,054.57	68.00	49,949.13	45.00	33,054.57
3	Removal of flumes	89.	only	40.00	3,560.00	34.00	3,026.00	40.00	3,560.00
4	Removal of guard rail	25.167	stas.	15.00	377.51	45.00	1,132.52	10.00	251.67
5	Type B Asph. conc. surf.	136.	tons	12.50	1,700.00	16.00	2,176.09	14.00	1,904.00
6	Incr. or decr. asph. cem.		per ton	24.00	.00	28.50	.00	27.00	.00
7	Prime & tack coat	74.	gal.	.50	37.00	.40	29.60	.30	22.20
8	Sand cover	03.	tons	7.50	22.50	9.00	27.00	4.00	12.00
9	Expansion joints	1226.	only	.60	735.60	.60	735.60	.50	613.00
10	Shoulders	734.546	stas.	9.00	6,610.91	40.00	29,381.84	8.72	6,405.24
11	Driveway surf. matl. Class A crushed stone	1115.	tons	4.00	4,460.00	5.00	5,575.00	3.40	3,791.00
12	Port. cem conc. curb filler	714.546	stas.	38.00	27,152.75	67.00	47,874.58	43.50	31,082.75
13	Port. cem. conc. curb filler latex modified.	10.	stas.	150.00	1,500.00	200.00	2,000.00	93.50	935.00
14	Port. cem conc. curb filler with epoxy bond	10.	stas.	100.00	1,000.00	75.00	750.00	68.50	685.00
	Total				81,035.84		142,946.11		82,935.18

No ties or reservations.

A P P E N D I X A

RECORD OF CONSTRUCTION AND MATERIAL BIDS Iowa State Highway Commission

DATE OF LETTING: May 9, 1961 LOCATION: On Iowa 64 from Polk County KIND OF WORK: Curb Removal
STARTING DATE: 5-22-61 line northeast to Story County PROJECT NO: FN-376 Widen
COMPLETION DATE: 7-22-61 line. 8.262 miles. BID ORDER NO: 113
COUNTY: Jasper(Cont.)

NAME OF CONTRACTOR CONTRACTOR'S ADDRESS AMOUNT OF BIDDER'S CHECK Req. Amt. \$4,000.00				THE MERRIC CO. DES MOINES, IA.		YEGGE-BLOSSER CONS. CO. BOONE, IA.	
No.	Item	Quantity	Unit	Unit Price	Amount	Unit Price	Amount
1	Class 10 excav rdwy & borrow	825.	cy	.50	412.50	1.00	825.00
2	Removal of curb	734.546	stas.	52.20	38,343.30	60.00	44,072.76
3	Removal of flumes	89.	only	40.00	3,560.00	40.00	3,560.00
4	Removal of guard rail	25.167	stas.	50.00	1,258.35	10.00	251.67
5	Type B Asph. Conc. surf.	136.	tons	15.00	2,040.00	12.00	1,632.00
6	Incr. or decr. asph. cem.		per ton	30.00	.00	30.00	.00
7	Prime & tack coat	74.	gal.	.50	37.00	.40	29.60
8	Sand cover	03.	tons	10.00	30.00	10.00	30.00
9	Expansion joints	1226.	only	.50	613.00	.30	367.80
10	Shoulders	734.546	stas.	25.00	18,363.65	14.00	10,283.64
11	Driveway surf. matl. Class A crushed stone	1115.	tons	3.25	3,623.75	4.00	4,460.00
12	Port. cem. conc. curb filler	714.546	stas.	58.00	41,443.67	75.00	53,590.95
13	Port. cem. conc. curb filler latex modified	10.	stas.	240.00	2,400.00	100.00	1,000.00
14	Port cem conc. curb filler with epoxy bond	10.	stas.	95.00	950.00	90.00	900.00
	Total				113,075.22		121,003.42

No ties or reservations.

A P P E N D I X A

RECORD OF CONSTRUCTION AND MATERIAL BIDS Iowa State Highway Commission

DATE OF LETTING: May 9, 1961 LOCATION: 0.715 mi. on Iowa 64 from Dallas KIND OF WORK: Curb Removal
STARTING DATE: 5-22-61 County line east to Grimes. PROJECT NO: FN-215 Widen
COMPLETION DATE: 7-22-61 BID ORDER NO: 114
COUNTY: Polk

NAME OF CONTRACTOR CONTRACTOR'S ADDRESS AMOUNT OF BIDDER'S CHECK Req. Amt. \$500.00				HALLETT CONS. CO. CROSBY, MINN. & BOONE, IA.		CENTRAL CONS. CO. INDIANOLA IA.		W. W. SALES CO. AMES, IOWA	
No.	Item	Quantity	Unit	Unit Price	Amount	Unit Price	Amount	Unit Price	Amount
1	Removal of curb	75.5	stas.	45.00	3,397.50	88.00	6,644.00	45.00	3,397.50
2	Removal of intakes	4.	only	30.00	120.00	34.00	136.00	100.00	400.00
3	22" x 13" corr. metal arch entr. culv.	24.	lf	6.25	150.00	5.50	132.00	6.00	144.00
4	Portland cem. conc. curb filler	75.5	stas.	45.00	3,397.50	67.00	5,058.50	78.50	5,926.75
5	Expansion joints	78.	only	.60	46.80	1.25	97.50	1.00	78.00
6	Shoulders	75.5	stas.	10.00	755.00	40.00	3,020.00	17.50	1,321.25
7	Driveway surf. matl. Class A crushed stone	72.	tons	4.50	324.00	5.00	360.00	3.50	252.00
	Total				8,190.80		15,448.00		11,519.50

Combination Bid: Dallas County Curb Removal Projects FN-751 and Polk County Curb Removal Project
FN-215 are tied. No other ties or reservations.

RECORD OF CONSTRUCTION AND MATERIAL BIDS
Iowa State Highway Commission

NAME OF CONTRACTOR CONTRACTOR'S ADDRESS AMOUNT OF BIDDER'S CHECK Req. Amt. \$500.00				JACKSON CONS. CO., INC. NEVADA, IA.		THE MARRIC CO. DES MOINES, IA.		YEGGE-BLOSSER CONS. CO. BOONE, IA.	
No.	Item	Quantity	Unit	Unit Price	Amount	Unit Price	Amount	Unit Price	Amount
1	Removal of curb	75.5	stas.	50.00	3,775.00	69.50	5,247.25	60.00	4,530.00
2	Removal of intakes	4.	only	75.00	300.00	50.00	200.00	75.00	300.00
3	22" x 13" corr. metal arch entr. culv.	24.	lf	5.00	120.00	6.00	144.00	5.00	120.00
4	Portland cem. conc. curb filler	75.5	stas.	62.00	4,681.00	68.50	5,171.75	75.00	5,662.50
5	Expansion joints	78.	only	1.00	78.00	1.00	78.00	.30	23.40
6	Shoulders	75.5	stas.	10.75	811.63	32.00	2,416.00	10.00	755.00
7	Driveway surf. matl. Class A crushed stone	72.	tons	4.00	288.00	3.70	266.40	4.00	288.00
	Total				10,053.63		13,523.40		11,678.90

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A P P E N D I X A

RECORD OF CONSTRUCTION AND MATERIAL BIDS Iowa State Highway Commission

DATE OF LETTING: May 9, 1961	LOCATION: 2.946 miles on U.S. 30 from point near S $\frac{1}{4}$ Cor. SE $\frac{1}{4}$ Sec. 5-83-22 east to point near S $\frac{1}{4}$ Cor. SE $\frac{1}{4}$ Sec. 2-83-22.	KIND OF WORK: Curb Removal
STARTING DATE: 5-22-61		PROJECT NO: FN-917 Widen
COMPLETION DATE: 7-22-61		BID ORDER NO: 115
		COUNTY: Story

NAME OF CONTRACTOR CONTRACTOR'S ADDRESS AMOUNT OF BIDDER'S CHECK Req. Amt. \$2,000.00				HALLETT CONS. CO. CROSBY, MINN. & BOONE, IA.		W. W. SALES CO. AMES, IA.	
No.	Item	Quantity	Unit	Unit Price	Amount	Unit Price	Amount
1	Class 10 excav rdwy & borrow	200.	cy	1.50	300.00	1.50	300.00
2	Removal of curb	186.901	stas.	50.00	9,345.05	50.00	9,345.05
3	Removal of flumes	19.	only	50.00	950.00	50.00	950.00
4	Removal of guard rail	7.166	stas.	25.00	179.15	25.00	179.15
5	22" x 13" corr. metal arch entr. culv.	78.	lf	6.25	487.50	6.00	468.00
6	Shoulders	186.901	stas.	12.00	2,242.81	20.00	3,738.02
7	Driveway surf. matl. Class A crushed stone	276.	tons	4.50	1,242.00	3.00	828.00
8	Port. cem. conc. curb filler	177.401	stas.	58.00	10,289.26	86.50	15,345.19
9	Asph. conc. curb filler	9.5	stas.	90.00	855.00	100.00	950.00
10	Expansion joints	443.	only	.60	265.80	1.00	443.00
11	Removal of existing structures	Lump Sum			500.00		250.00
	Total				26,656.57		32,796.41

No ties or reservations.

A P P E N D I X A

RECORD OF CONSTRUCTION AND MATERIAL BIDS Iowa State Highway Commission

DATE OF LETTING: May 9, 1961	LOCATION: 2.946 miles on U.S. 30 from	KIND OF WORK: Curb Removal
STARTING DATE: 5-22-61	point near S $\frac{1}{4}$ Cor. SE $\frac{1}{4}$ Sec.	PROJECT NO: FN-917 Widew
COMPLETION DATE: 7-22-61	5-83-22 east to point near S $\frac{1}{4}$	BID ORDER NO: 115
	Cor. SE $\frac{1}{4}$ Sec. 2-83-22.	COUNTY: Story (Cont.)

NAME OF CONTRACTOR CONTRACTOR'S ADDRESS AMOUNT OF BIDDER'S CHECK Req. Amt. \$2,000.00				JACKSON CONS.CO., INC. NEVADA, IA.		YEGGE-BLOSSER CONS. CO. BOONE, IA.	
No.	Item	Quantity	Unit	Unit Price	Amount	Unit Price	Amount
1	Class 10 excav rdwy & borrow	200.	cy	1.00	200.00	1.00	200.00
2	Removal of curb	186.901	stas.	40.00	7,476.04	60.00	11,214.06
3	Removal of flumes	19.	only	40.00	760.00	40.00	760.00
4	Removal of guard rail	7.166	stas.	10.00	71.66	10.00	71.66
5	22" x 13" Corr. metal arch entr. culv.	78.	lf	5.00	390.00	5.00	390.00
6	Shoulders	186.901	stas.	10.00	1,869.01	14.00	2,616.61
7	Driveway surf. matl. Class A crushed stone	276.	tons	4.00	1,104.00	3.00	828.00
8	Port. cem. conc. curb filler	177.401	stas.	50.00	8,870.05	75.00	13,305.08
9	Asph. conc. curb filler	9.5	stas.	75.00	712.50	120.00	1,140.00
10	Expansion joints	443.	only	.50	221.50	.30	132.90
11	Removal of existing structures	Lump Sum			100.00		50.00
	Total				21,774.76		30,708.31

No ties or reservations.

A P P E N D I X A

FINAL ESTIMATE OF ROAD OR BRIDGE WORK

COUNTY: Story ROAD: 05 Primary PROJECT: FN-917
 TYPE OF WORK: Curb Removal PAYABLE TO: Jackson Construction Co. Inc. ESTIMATE NO: 4J Final
 DATE OF ESTIMATE: September 11, 1961 ADDRESS: Nevada, Iowa SHEET NO: 1 of 2

NO.	Classification	ITEMS	Unit	QUANTITIES			AMOUNTS			
				RATES	CONTRACT	ACTUAL	UNDERRUN	CONTRACT	ACTUAL	UNDERRUN
		Contract Work								
1	101	Class 10 excav rdwy & borrow	cy	1.00	200	200		200.00	200.00	
2	101	Removal of curb	sta	40.00	186.901	183.670	3.231	7,476.04	7,346.80	129.24
3	101	Removal of flumes	ea	40.00	19	18	1	760.00	720.00	40.00
4	101	Removal of guard rail	sta	10.00	7.166	7.166		71.66	71.66	
5	101	22" x 13" corr. metal arch entrance culvert	lf	5.00	78	78		390.00	390.00	
6	101	Shoulders	sta	10.00	186.901	183.670	3.231	1,869.01	1,836.70	32.31
7	105	Driveway surf. matl. Class A crushed stone	ton	4.00	276	214.60	61.40	1,104.00	858.40	245.60
8	101	Port.cem. con. curb filler	sta	50.00	177.401	174.290	3.111	8,870.05	8,714.50	155.55
9	101	Asph.conc. curb filler	sta	75.00	9.50	9.38	0.12	712.50	703.50	9.00
10	101	Expansion joints	ea	0.50	443	434	9	221.50	217.00	4.50
11	101	Removal of exist. struct.	\$	Lump Sum				100.00	100.00	
		Totals						21,774.76	21,158.56	616.20
		Pd. previous vouchers 1J to 3J sub-final incl.							19,042.70	
		Due this 4J final Voucher							2,115.86	

ORIGINAL CONTRACT AMOUNT: \$21,774.76 - 100.00%

NET UNDER RUN: \$616.20 - 2.83%

TOTAL AMOUNT PAID: \$21,158.56 - 97.17%

APPENDIX A

FINAL ESTIMATE OF ROAD OR BRIDGE WORK

COUNTY: Jasper ROAD: 05 Primary PROJECT: FN-376
 TYPE OF WORK: Curb Removal PAYABLE TO: Hallett Construction Co. ESTIMATE NO: 4G Final
 DATE OF ESTIMATE: September 12, 1961 ADDRESS: Crosby, Minnesota SHEET NO: 1 of 2

NO	Class ifica tion	ITEMS	Unit	RATES	QUANTITIES				AMOUNTS			
					CONTRACT	ACTUAL	OVER RUN	UNDER RUN	CONTRACT	ACTUAL	OVER RUN	UNDER RUN
		Contract Work										
1	101	Class 10 excav. rdwy & borrow	cy	1.00	825	825			825.00	825.00		
2	101	Removal of curb	sta	45.00	734.546	724.920		9.626	33,054.57	32,621.40		433.17
3	101	Removal of flumes	ea	40.00	89	89			3,560.00	3,560.00		
4	101	Removal of guard rail	sta	15.00	25.167	25.167			377.51	377.51		
5	104	Type B Asph. con. surface	ton	12.50	136	136.15	0.15		1,700.00	1,701.88	1.88	
6	104	Incr. or decr. asph. cement	ton	24.00		0.50	0.50			12.00	12.00	
7	104	Prime and tack coat	gal	0.50	74	58		16	37.00	29.00		8.00
8	104	Sand cover	ton	7.50	3	4	1		22.50	30.00	7.50	
9	101	Expansion joints	ea	0.60	1226	1232	6		735.60	739.20	3.60	
10	101	Shoulders	sta	9.00	734.546	724.920		9.626	6,610.91	6,524.28		86.63
11	105	Driveway surf. matl. cl. a crushed stone	ton	4.00	1115	591.75		523.25	4,460.00	2,367.00		2,093.00
12	101	Port. cem. con. curb filler	sta	38.00	714.546	705.130		9.416	27,152.75	26,794.94		357.81
13	101	Port. cem. con. curb filler latex mod.	sta	150.00	10.0	9.79		0.21	1,500.00	1,468.50		31.50
14	101	Port. cem. con. curb filler w. epoxy bond	sta	100.00	10.0	10.00			1,000.00	1,000.00		
		Totals							81,035.84	78,050.71	24.98	3,010.11
		Pd. previous voucher										
		1G-3G Sub-Final incl								70,245.64		
		Due 4G final voucher								7,805.07		

ORIGINAL CONTRACT: \$81,035.84 - 100.00% NET UNDERRUN: \$2,985.13 - 3.68% TOTAL PAID: \$78,050.71 - 96.32%

A P P E N D I X A

FINAL ESTIMATE OF ROAD OR BRIDGE WORK

COUNTY: Polk	ROAD: 05 Primary	PROJECT: FN-215(00)
TYPE OF WORK: Curb Removal	PAYABLE TO: Hallett Construction Co.	ESTIMATE NO: 3F Final
DATE OF ESTIMATE: August 18, 1961	ADDRESS: Crosby Minnesota	SHEET NO: 1 of 1

NO	CLASSIFICATION	ITEMS	Unit	RATES	QUANTITIES				AMOUNTS			
					CONTRACT	ACTUAL	OVER RUN	UNDER RUN	CONTRACT	ACTUAL	OVER RUN	UNDER RUN
		Contract Work										
1	01	Removal of Curb	sta	45.00	75.5	75.539	0.039		3,397.50	3,399.26	1.76	
2	01	Removal of Intakes	only	30.00	4	4			120.00	120.00		
3	01	22" x 13" Corr. Metal Arch Entrance culvert	lf	6.25	24	24			150.00	150.00		
4	02	Port. cem. con. curb filler	sta	45.00	75.5	75.539	0.039		3,397.50	3,399.26	1.76	
5	02	Expansion joints	only	0.60	78	7		71	46.80	4.20		42.60
6	01	Shoulders	sta	10.00	75.5	75.539	0.039		755.00	755.39	.39	
7	05	Driveway Surfacing Material, Class A Crushed stone	ton	4.50	72	72			324.00	324.00		
		Totals							8,190.80	8,152.11	3.91	42.60
		Pd. previous vouc.										
		1F-2F Sub-Final								7,336.90		
		Due 3F final vouc.								815.21		

ORIGINAL CONTRACT AMOUNT: \$8,190.80 - 100.0%

NET UNDERRUN: \$38.69 - 0.5%

TOTAL AMOUNT PAID: \$8,152.11 - 99.5%

APPENDIX A

FINAL ESTIMATE OF ROAD OR BRIDGE WORK

COUNTY: Dallas ROAD: 05 Primary PROJECT: FN-751(00)
 TYPE OF WORK: Curb Removal PAYABLE TO: Hallet Construction Co. ESTIMATE NO: 4A Final
 DATE OF ESTIMATE: August 24, 1961 ADDRESS: Crosby, Minnesota SHEET NO: 1 of 2

NO	Class	ITEMS	Unit	RATES	QUANTITIES				AMOUNTS			
					CONTRACT	ACTUAL	OVER RUN	UNDER RUN	CONTRACT	ACTUAL	OVER RUN	UNDER RUN
1	01	Class 10 Excav. rdwy. & borrow	cy	1.00	150	150			150.00	150.00		
2	01	Removal of curb	sta	45.00	286.257	287.586	1.329		12,881.57	12,941.37	59.80	
3	01	Removal of flumes	only	45.00	25	25			1,125.00	1,125.00		
4	02	Port. cem. con. curb filler	sta	45.00	266.457	267.786	1.329		11,990.57	12,050.37	59.80	
5	02	Por. cem. con. curb, epoxy bond	sta	100.00	9.9	9.9			990.00	990.00		
6	02	Por. cem. con. curb fil. lat. mod.	sta	150.00	9.9	9.9			1,485.00	1,485.00		
7	01	Shoulders		10.00	286.257	287.586	1.329		2,862.57	2,875.86	13.29	
8	05	Driveway Surf. Material										
		Class A crushed stone	ton	4.50	346.0	342.25		3.75	1,557.00	1,540.13		16.87
9	02	Expansion joints	only	0.60	292	288		4	175.20	172.80		2.40
		<u>EXTRA WORK ORDER NO. 1</u>										
	01	Furnish and place 20' x 18" Cor. Metal pipe in exist. ent. at sta. 984+75 South Side	lf	4.75		20	20			95.00	95.00	
		<u>EXTRA WORK ORDER NO. 2</u>										
	01	Furnish and place 24' x 18" cor. metal pipe exist. farm ent. lt. sta. 770+27	lf	4.75		24	24			114.00	114.00	
		<u>EXTRA WORK ORDER NO. 3</u>										
		(Blanket)										
	01	Place only 20' x 24" con. ent. pipe	lf	1.25		20	20			25.00	25.00	
		Totals							33,216.91	33,564.53	366.89	19.27
		Pd. previous voucher										
		1A-3A Sub-Final incl.								30,208.08		
		Due 4A voucher								3,356.45		

ORIGINAL CONTRACT: \$33,216.91 - 100.0% NET OVERRUN: \$347.62 - 1.0% TOTAL PAID: \$33,564.53 - 101.0%

IOWA STATE HIGHWAY COMMISSION
Ames, Iowa

SUPPLEMENTAL SPECIFICATION
for
CURB REMOVAL

May 9, 1961

462.01 DESCRIPTION. This work involves the removal of curb from present pavement and the restoration of the riding surface over the area from which curb has been removed. All work shall be done according to the plans and these specifications.

462.02 REMOVAL OF FLUMES. Article 2302.06 shall apply.

462.03 REMOVAL OF CURB. The curb shall be removed in the following manner:

A saw cut shall be made at the point of curb or not to exceed 1/2 inch away from the curb. The saw cut shall have a depth not less than 1-1/2 inches. The saw cut shall be inclined undercutting the pavement surface that is to remain. The undercut shall be approximately 1/8 inch.

At the end of the curb section, the saw cut shall be extended to the extreme end of the curb. At this point a saw cut shall be made at right angles to the centerline of the pavement and extending from the end of the saw cut just described to the adjacent edge of the pavement. The concrete of the old curb shall be removed to a depth not less than 1-1/2 inches below a tangent of the surface extended from the edge of the pavement. Every reasonable precaution shall be taken to limit the depth of this break to 2-1/2 inches below the tangent described above.

The curb may be removed by any method which does not damage the concrete which is to remain in place.

Immediately before breaking the curb, the groove formed by sawing shall be cleaned and made free of dirt, stones or any foreign matter for a depth of not less than one inch below the surface of the pavement. Material removed from curb shall be disposed of as directed by the engineer. Any steel reinforcement in the old pavement, which is exposed and loosened by removal of curb, shall be cut off and removed.

462.04 PLACEMENT OF CURB FILLER. The surface of the pavement shall be restored by placing the designated curb filler on the area from which the curb was removed.

A. Portland Cement Concrete Curb Filler shall be placed by the following method:

For a period of one hour prior to the placement of concrete, the area shall be kept wet. Immediately prior to placing the concrete, the surface shall be freed of any standing pools of

Spec. 462-2

of water by brooming or by the use of compressed air, then treated with grout in the following manner.

The grout shall be prepared by mixing one part portland cement, one part concrete sand (with plus #8 material removed), approximately 1/2 part water to produce a thick creamy consistency. The grout shall be thoroughly broomed into and over the surface to produce a film of about 1/16 inch thickness. The grout should not be allowed to dry to the extent that it develops a whitish appearance. If due to unavoidable causes this drying condition does occur, the grout shall be immediately removed by brushing, scraping and flushing with water. A fresh treatment of grout shall be placed when operations are to be resumed.

Standard concrete complying with Section 2301 shall be used for curb filler, except that the maximum particle size in coarse aggregate shall be 1 inch. Coarse aggregate complying with 4115.06B will be acceptable. Appropriate parts of Section 2301 may be considered as applicable to this work. The method of placement shall include a suitable means of vibration.

The outside edge of the concrete as placed shall be flush with the edge of the old pavement, or the concrete may be flush at its lower edge and slope toward the centerline not more than 1/2 inch in its vertical rise. Under no circumstances will any overhang of the old pavement be permitted in the finished work. This outer edge may be formed or shaped with an approved mule, or forms made of metal or straight wood may be used. The top of the form shall be set by straight edging off the surface of adjacent pavement, and flush with vertical edge of old pavement. The forms shall be securely held in place both vertically and horizontally. The edge adjacent to a metal form with rounded edges shall be tooled to a 1/8 inch radius. Forms shall extend two inches below the bottom of the new concrete and need not be left in place after concrete will stand without slumping. At the contractor's option, short saw kerfs 3/4 inch deep may be cut in the old pavement near the full length cut at 4 or 5 feet intervals for the purpose of clamping forms to the old slab. If these kerfs are sawed, they shall be filled with joint sealer after clamps are removed. If a slip form or mule is used for shaping the concrete, the outer edge shall be built true to line and grade. The surface of the filler portion shall be a tangent continuation of the adjacent pavement flush at the saw cut. In the event occasional overhang does occur in the construction operations, the overhang shall be removed prior to the final setting of the concrete, with combined horizontal and downward shearing strokes of a trowel. If this operation tears aggregate from the concrete the entire filler shall be promptly removed and replaced including a fresh treatment of the

Spec. 462-4

thoroughly scratched with a stiff steel bristled brush and epoxy resin shall be re-applied to the surface before the curb filler is placed.

Portland cement curb filler shall be placed by the method specified in Paragraph A.

C. Portland Cement Concrete Curb Filler Using Latex.

Immediately after the removal of curb the area shall be swept clean to remove all dust and other foreign material, then wetted with water and kept wet for not less than one hour and until the area is ready to be filled with latex modified portland cement concrete. Just prior to the placement of the latex concrete, any accumulations of free water on the irregular surface shall be removed by sweeping or by compressed air.

The placement of latex modified portland cement concrete shall follow curb removal operations not later than one working day. Latex mortar shall be brushed onto the damp surface using a stiff brush in lieu of the grout coat specified in 462.04A.

The applicable portions of the Section 462.04A will apply to the placement of concrete with these modifications.. Latex concrete shall not be placed when the temperature is below 48°F., nor when freezing temperatures are apt to occur within 24 hours after placement.

The concrete and mortar shall be of the composition as directed by the engineer and written recommendations by the manufacturer. It is suggested that the contractor consult with a manufacturer of ingredients for the production of latex portland cement concrete to obtain information relative to raw material costs and area coverage data of latex modified concretes; also, information on handling and mixing.

The latex shall be approved by the engineer.

The crack on the surface of the pavement between the old concrete and the latex modified concrete curb filler shall be filled with an epoxy resin. This epoxy resin shall be approved by the engineer, shall be applied according to the written recommendations of the manufacturer and shall be under the direct control of the engineer.

D. Asphaltic Concrete Curb Filler shall be placed as follows:

1. Placement. The clean surface upon which asphaltic concrete is to be placed shall be tacked with RC-0 at a rate only sufficient to obtain complete coverage without the formation of pools. In the event tack coat is spread by hand methods the RC-0 may be cut

Spec. 462-6

however, transversely the finished surface shall be a tangent extension of the pavement slab and shall be flush at the sawed edge.

4. Trimming of Edge. After the final rolling and prior to the backfilling of the edge with shoulder material, any extrusion of asphaltic concrete over the edge shall be cut flush or the asphaltic concrete may be sloped not more than one inch toward the centerline. Any tool or machine used for the purpose of trimming this edge shall exert a downward pressure instead of a lifting force.

462.05 EXCAVATION. Any excavation by the contractor for the purpose of removing the curb or placing the curb filler will be considered incidental work. Excavated material shall be backfilled and thoroughly compacted by loaded pneumatic tired equipment.

462.06 LIMITATIONS. Traffic will be permitted to use the routes involved and shall not be delayed unnecessarily. Articles 1107.08 and 1107.09 shall apply as for widening projects.

No curb shall be removed unless it is anticipated that the curb filler will be in place at the end of the next working day's operation. No curb shall be removed from any edge of pavement when traffic is restricted from using the opposite pavement edge and shoulder.

It is essential to the success of this work that the saw cut and broken concrete surface be clean at the time the curb filler is placed. Any area contaminated with dirt, dust, oil, or any other foreign material shall be cleaned by brushing, scraping, washing or any other method or combination of methods necessary to secure a cleaned surface. Effective means shall be taken to minimize the possibility of recurrence.

Materials excavated for the purpose of curb removal shall not be replaced until the curb filler is in place.

462.07 OPENING TO TRAFFIC. The pavement upon which asphaltic concrete curb filler has been placed may be opened to traffic as soon as the material excavated for curb removal has been replaced adjacent to the pavement.

The pavement upon which other types of curb filler have been placed may be opened to traffic as soon after the concrete has attained the age of four days and tests of beam specimens indicate that the concrete has attained a modulus of rupture not less than 500 psi and the material excavated for curb removal has been replaced adjacent to the pavement.

462.08 SHOULDERS. When shouldering is a part of the contract, 2302.11 shall apply.

462.09 METHOD OF MEASUREMENT. The various items involved in curb removal will be measured as follows:

- A. Curb Removal. The number of stations of curb removed shall be measured along each edge of the pavement.

B. Curb Filler. The number of stations of curb filler of each type placed in acceptable portions of the work will be measured along each edge of the pavement.

1. Portland Cement Concrete
2. Portland Cement Concrete, Latex Modified
3. Portland Cement Concrete with Epoxy Resin Bond
4. Asphaltic Concrete

C. Shoulders. Paragraph 2302.15D shall apply.

D. Joint Sealing. The sealing of joints will not be measured for payment.

E. Contraction Joints. The construction and sealing of contraction joints will not be measured for payment.

F. Expansion Joints. Paragraph 2302.15G shall apply except when asphaltic concrete curb filler is used.

G. Removal of Flumes. Paragraph 2302.15H shall apply.

462.10 BASIS OF PAYMENT. For the quantity of various items involved in curb removal, measured as provided above, the contractor will be compensated as follows:

A. Curb Removal. For the number of stations of curb removed, the contractor shall be paid the contract unit price per station.

B. Curb Filler. For the number of stations of curb filler of each type placed in accepted portions of the work, the contractor will be paid the contract unit price per station,

1. Portland Cement Concrete
2. Portland Cement Concrete, Latex Modified
3. Portland Cement Concrete with Epoxy Resin Bond
4. Asphaltic Concrete

C. Shoulders. Paragraph 2302.16D shall apply.

D. Joint Sealing. The cost of sealing expansion joints will be included in the contract price for expansion joints.

E. Contraction Joints. Construction of contraction joints will not be paid for separately.

F. Expansion Joints. Paragraph 2302.16G shall apply.

G. Removal of Flumes. Paragraph 2302.16H shall apply. The provisions of 1109.03 will not apply to the item of expansion joints.

with equal parts of white (lead free) gasoline. If for any reason pools of asphalt accumulate in depressions, they shall be brushed out immediately. The placement of asphaltic concrete may follow tacking operations after one hour.

The composition and quality of the mixture, paving plant, construction equipment and construction methods shall be in accordance with 2303 with the following modifications and other modifications adaptable to the work involved.

The mixture size designation shall be 1/2 inch. The requirements of laboratory mix design, 2303.02D1 and 2, may be modified or omitted entirely at the discretion of the engineer.

The engineer may modify any of the equipment requirements of Section 2303 necessary or desirable for prosecution of this work and not in conflict with the following.

- a. The paving plant shall have a capacity of not less than 5 cubic feet of mixture and may be of the type designed for maintenance patching. The plant shall consistently produce a mixture of acceptable asphaltic concrete and shall be approved by the engineer. The asphalt content of the mixture will be set by the engineer. No payment shall be made for increase or decrease in asphalt quantities.
 - b. Hand spreading methods may be used for placing the asphaltic concrete, but these shall include a tool which will strike off the uncompacted mixture to its proper elevation.
 - c. Suitable rollers loaded to produce a compressive force not less than 250 pounds per inch width of roller shall be used.
 - d. Trucks used for transporting the hot mixture shall comply with 2001.03A.
2. Rolling. After the layer of hot asphaltic concrete has been spread, it shall be rolled to obtain specified density. Not less than one initial and one final rolling will be required. An intermediate rolling with pneumatic tires may or may not be required at the discretion of the engineer. The final surface shall be reasonably free of roller marks, tears and voids.
 3. Smoothness. The smoothness of the asphaltic concrete will not be tested with the ten foot straightedge;

irregular surface. The finished surface shall contain no abrupt irregularities and have a uniform texture obtained by a wood float or burlap drag. The finished surface will not be checked for smoothness with the ten foot straight edge.

Contraction joints shall be installed above existing contraction joints.

This joint shall be formed by inserting a removable metal plate into the joint. This plate shall be approximately 1/4 inch thick at its top edge and approximately 1/8 inch wide at its bottom edge. The plate shall be deep enough to extend at least 1/2 inch into the groove of the old pavement and shall set flush with the top of the proposed curb filler.

The plate shall remain in place until the concrete will stand without slumping. Prior to opening the pavement to traffic the contraction joint shall be sealed with material specified in 2302.10.

Expansion joints shall be installed above expansion joints existing in the old pavement. The method specified in 2302.08D or any other method producing equal results and acceptable to the engineer may be used. Joints shall be sealed with material specified in 2302.10.

The concrete curb filler shall be protected and cured using plastic film complying with Section 4106, except that the width shall be suitable to the work. The plastic film shall be placed as soon as the surface will allow placement without marring. The film shall cover the vertical and horizontal surfaces, and shall be held in place by earth.

B. Portland Cement Concrete Curb Filler Using Epoxy Resin.

Prior to the placement of concrete, all the surfaces against which concrete is to be placed shall be brushed clean and then treated with an epoxy resin approved by the engineer. This material shall be applied using a method acceptable to the engineer which provides a thickness of not less than 10 mils. All phases of the operations involving the use of the epoxy resin shall follow the written recommendations of the manufacturer, but shall be under the direct control and subject to the approval of the engineer.

Epoxy resin shall not be placed on a damp surface and shall not be used when the temperature is below 60°F. The engineer may suspend operations when a 60°F. temperature is not anticipated on the day following placement. When in the opinion of the engineer the epoxy resin is no longer tacky enough to provide a bond, the surface of the epoxy resin shall be

A P P E N D I X C

Research Project HR-76, Curb Removal

A FIVE YEAR ACCIDENT STUDY OF 18' PAVING
WITH AND WITHOUT CURBS

March, 1961

Prepared by Traffic & Highway Planning
Department, Division of Planning

18' PAVING WITHOUT CURBING
ACCIDENTS FROM 1954 THRU 1958

District	Traffic ADT	County	Approx. Length In Miles	Route No.	Location	Accidents		
						Curb*	Flume	Misc.
1	1230	Dallas	5	Ia 64	Guthrie Co. Line E. to N.W. Cor. 1-79-29	1	1	12
1	4290	Marshall	3½	US 30	7-83-19 E. to Co. Trk. Rd. R.	3	0	40
2	1190	Howard	5	US 63	Jct. Ia. 9 N. to N.W. Cor. Sec 32-100-12	1	0	14
2	1610	Winnebago	3½	Ia 9	N.W. Cor. Sec. 19-99-25 E. to Cen Sec. 22-99-25	0	0	5
3	1200	O'Brien	6½	US 59	NCL Primgar to Jct. US 18	1	1	20
3	850	Woodbury	3½	Ia 141	Co. Trk Rd. N. South to Co. Trk. Rd. S.	0	0	14
4	1570	Adams	8	US 34	Ia. 148 E. to Jct. Ia. 49	2	1	22
4	2000	Cass	7	US 71	Montgomery Co. Line N. to Jct. Ia. 92	1	2	33
5	730	Des Moines	5	Ia 99	NCL Burlington to Sec. 35-71-2	2	0	28
5	1680	Lee	6	US 218	NCL Donnellson to Jct. of Ia. 103	1	1	27
6	2700	Linn	5	Ia 149	NCL Fairfax to SCL Cedar Rapids	2	0	39
6	1040	Scott	7½	Ia 150	Cedar Co. line to Plainview	3	0	47
Totals	20090		65.5			16	6	301

*Curbing may have prevented accidents

18' PAVING WITHOUT CURBING
ACCIDENTS FROM 1954 THRU 1958

Sheet 1 of 3

DATE	TIME		SURFACE CONDITION	FATALITIES	PERSONAL INJURIES	PROPERTY DAMAGE	TYPE OF VEHICLES INVOLVED	MAJOR CAUSE OF ACCIDENT	CLASSIFICATION OF ACCIDENT AND BRIEF STATEMENT OF CIRCUMSTANCES
	A.M.	P.M.							
<u>Cass</u>									#1 started to pass at H.C. - pulled back to avoid collision with on coming car - applied brakes - hit soft shoulder - went into the ditch and overturned.
9-16-57	9:35		Dry	0	0	500	1 car	Passing	
<u>Dallas</u>									#1 pull to the Rt. to avoid #2 who was passing - hit soft shoulder - lost control - struck a post & rolled over into the ditch.
3-3-58		1:45	Dry	0	0	300	1 car	Dodging Vehicle	
<u>Lee</u>									#1 came over hill to find #2 just entering Hwy from local Rd. - unable to stop #1 dodged Rt. lost control skidding to Rt. shoulder then across rd. to the L. & careened into a farm lot.
2-19-58		2:30	Dry	0	0	525	1 car	Dodging Vehicle	
<u>Linn</u>									#1 got off on soft shoulder - in attempting to come back on lost control - went in the E. ditch where he rolled over.
6-12-55	2:40		Dry	0	1	300	1 car	Soft Shoulder	
<u>Linn</u>									#1 claimed her Rt. wheels dropped off paving onto shoulder into deep ruts - lost control & overturned on L. shoulder.
4-23-57	10:15		Dry	0	1	500	1 car	Skidding on Shoulder	
<u>Des Moines</u>									#1 hit soft shoulder as he rounded curve - lost control & skidded off Rd.
5-1-54	12:45		Wet	0	2	1500	1 car	Skidding on Shoulder	
<u>Des Moines</u>									#1 ran off roadway on curve - rolling over.
7-28-56		7:15	Dry	0	0	1200	1 car	Curve	

18' PAVING WITHOUT CURBING
ACCIDENTS FROM 1954 THRU 1958

Sheet 2 of 3

DATE	TIME		SURFACE CONDITION	FATALITIES	PERSONAL INJURIES	PROPERTY DAMAGE	TYPE OF VEHICLES INVOLVED	MAJOR CAUSE OF ACCIDENT	CLASSIFICATION OF ACCIDENT AND BRIEF STATEMENT OF CIRCUMSTANCES
	A.M.	P.M.							
<u>Howard</u> 7-2-54	Daylight		Dry	0	0	400	1 car	Skidding on Shoulder	#1 hit loose material on shoulder - lost control of car & left the roadway
<u>Marshall</u> 7-12-54		12:15	Dry	0	1	200	2 cars	Skidding on Shoulder	#1 dropped onto soft shoulder (on curve) - lost control when he pulled back & hit on coming #2.
<u>Marshall</u> 6-17-57		5:00	Wet	0	1	350	1 car	Skidding on Shoulder	#1 dropped off paving in a heavy rain - started fish-tailing as he came back on Hwy. - then ran off roadway on opposite side.
<u>Marshall</u> 7-21-57		5:15	Wet	0	0	305	1 car	Skidding on Wet Surface	#1 skidded on Hwy in heavy rain - lost control & spun around - slid off rd. & thru a fence.
<u>O'Brien</u> 3-24-54		9:00	Wet	0	2	800	1 car	Passing	#1 got off on soft shoulder as he passed #2 - #1 lost control & ended up in the ditch on the opposite side of the rd.
<u>Scott</u> 9-24-55	1:00		Dry	0	0	500	1 car	Dodging Vehicle	#1 took Rt. shoulder to avoid on coming #2 - when #1 tried to get back on the rd. he lost control & upset in opposite ditch.
<u>Scott</u> 9-19-57	1:45		Dry	0	0	600	1 car	Dodging Vehicle	#1 ran off on Rt. shoulder to avoid on coming #2 - #1 careened across the road & rolled over into the ditch.

18' PAVING WITHOUT CURBING
ACCIDENTS FROM 1954 THRU 1958

Sheet 3 of 3

DATE	TIME		SURFACE CONDITION	FATALITIES	PERSONAL INJURIES	PROPERTY DAMAGE	TYPE OF VEHICLES INVOLVED	MAJOR CAUSE OF ACCIDENT	CLASSIFICATION OF ACCIDENT AND BRIEF STATEMENT OF CIRCUMSTANCES
	A.M.	P.M.							
<u>Scott</u>									
10-4-57		1:00	Dry	0	1	450	1 semi	Skidding on Shoulder	#1 hit soft shoulder on curve - lost control as he pulled back on Hwy - ran off same side of Rd & into the ditch.
<u>Adams</u>									
12-29-54		3:00	Icy	0	2	175	1 pickup	Skidding on Shoulder	#1 got off on Rt. shoulder - lost control & upset on Highway.
<u>Adams</u>									
7-3-58	2:30		Dry	0	0	300	1 car	Skidding on Shoulder	#1 hit Rt. shoulder - lost control as he came back on paving & left the Rd. on the opposite side rolling over.

18' PAVING WITHOUT CURBING & WITH FLUMES
ACCIDENTS FROM 1954 THRU 1958

SHEET 1 of 1

DATE	TIME		SURFACE CONDITION	FATALITIES	PERSONAL INJURIES	PROPERTY DAMAGE	TYPE OF VEHICLES INVOLVED	MAJOR CAUSE OF ACCIDENT	CLASSIFICATION OF ACCIDENT AND BRIEF STATEMENT OF CIRCUMSTANCES
	A.M.	P.M.							
<u>Cass</u>									#1 was passing #2 when #2 pulled out to pass #3 - #1 pulled to the L. to avoid #2 & hit flume - this caused #1 to roll over into the ditch.
2-13-54		3:45	Dry	0	0	450	1 car	Passing	
<u>Cass</u>									#1 swerved out to pass #2 at H.C. - saw on coming semi - applied brakes - hit flume - lost control & rolled over into the ditch.
11-12-56		12:30	Dry	0	0	600	1 car	Passing	
<u>Lee</u>									#1 started to pass #2 - #2 moved over & #1 had to pull still more to the L. - hit flume & this threw #1 back into L. side of #2 - #2 then hit the bridge.
11-14-55		2:00	Dry	0	0	250	2 cars	Passing	
<u>Dallas</u>							1 car tractor	Dodging Flume	Farm tractor & hay rake had been driving along shoulder - then pulled out onto paving to go around flume - failed to see #1 approaching from the rear & sideswiped #1.
8-23-56	11:30		Dry	0	0	100	hay rake		
<u>O'Brien</u>								Skidding on ice	#1 spun around on ice - hit flume & plunged thru ditch & into fence.
1-6-57		1:15	Icy	0	0	140	1 car		
<u>Adams</u>							1 car	Windshield Coated	As car #1 passed semi the semi threw up muddy water coating #1's windshield - #1 drove to Rt. & struck a flume.
3-4-55	6:30		Wet	0	1	400	1 semi		

18' PAVING WITH CURBING
ACCIDENTS FROM 1954 THRU 1958

DISTRICT	TRAFFIC ADT	COUNTY	APPROX. LENGTH IN MILES	ROUTE NO.	LOCATION	ACCIDENTS		
						CURB*	FLUME	MISC.
1	1490	Grundy	5	Ia 57	Harden Co. Line E to Jct. Ia. 14	1	0	16
1	3920	Story	3½	US 30	ECL Nevada to N.W. Cor. Sec. 12-83-02	7	2	50
2	1230	Allamakee	4	Ia 9	WCL Waukon W. to N.W. Sec 33-98-6	0	0	20
2	2050	Franklin	5½	Ia 3	Jct. Ia. 263 E. to N.W. Cor. Sec 31-92-20	0	0	27
3	780	Clay	5	Ia 10	ECL peterson to Jct. Ia. 264	0	0	5
3	1570	Palo Alto	7	US 18	ECL Ruthven to Jct. Ia. 17	0	1	26
4	1330	Adams	8	US 34	Montgomery Co. E. to N.W. Cor. Sec. 33-72-34	2	1	35
4	850	Audubon	6	Ia 64	N.W. Cor. Sec. 7-79-35 to W. Guthrie Co. line	1	1	22
5	1680	Henry	6	US 218	SCL Mt. Pleasant to Jct. Ia. 125	3	1	55
5	2400	Davis	4½	US 63	Sec 18-69-13 N. to Co. Trk. Rd. D	3	3	42
6	1080	Clayton	7	US 52	Jct. Ia. 128 N. to Jct. Ia. 13	1	0	28
6	1100	Delaware	4	Ia 13	Co. Trk. Rd. K. N. to Cor. Sec. 8-90-5	0	0	10
Totals	19480		65.5			18	9	336

*Curbing was major cause of accident

18' PAVING WITH CURBING
ACCIDENTS FROM 1954 THRU 1958

Sheet 1 of 3

DATE	TIME		SURFACE CONDITION	FATALITIES	PERSONAL INJURIES	PROPERTY DAMAGE	TYPE OF VEHICLES INVOLVED	MAJOR CAUSE OF ACCIDENT	CLASSIFICATION OF ACCIDENT AND BRIEF STATEMENT OF CIRCUMSTANCES
	A.M.	P.M.							
<u>Grundy</u>									
11-27-57		5:00	Dry	0	0	350	semi car	Passing	#1 started to pass - hit curb at L. side of paving - this caused #1 to swerve back into side of semi.
<u>Story</u>									
2-26-55		5:05	Wet	0	1	1500	truck semi	Hit Curbing	Semi met on coming truck which was riding the center line - semi attempted to swerve to the Rt. - hit curbing & sideswiped on coming truck.
<u>Story</u>									
9-17-55		10:15	Dry	0	1	800	2 cars	Passing	#1 passed #3 - saw on coming #2 - cut back to the Rt. sharply - hit curb & shoulder - this caused #1 to swerve back into L. traffic lane hitting #2 head on.
<u>Story</u>									
6-6-56	8:15		Dry	0	1	800	1 car	Curve	#1 hit curbing on curve - lost control & hit a road sign - plunging down embankment.
<u>Story</u>									
3-8-57		5:45	Icy	0	1	100	1 car	Skidding	#1 slid on icy paving on curve - hit curb and plunged down embankment.
<u>Story</u>									
9-12-57		9:30	Dry	0	1	150	1 car	Blinded by Headlights	#1 blinded by headlights of on coming #2 - hit curb & shoulder at sharp curve - lost control - crossed rd. & hit underpass.
<u>Story</u>									
9-14-57	7:50		Dry	0	3	1850	2 cars 1 house- trailer	Hit Curbing	#2 stated his Rt. wheels hit curbing causing the housetrailer to rock - housetrailer came loose from car & overturned - #2 then lost control of his car & hit on coming #1.

18' PAVING WITH CURBING
ACCIDENTS FROM 1954 THRU 1958

Sheet 2 of 3

DATE	TIME		SURFACE CONDITION	FATALITIES	PERSONAL INJURIES	PROPERTY DAMAGE	TYPE OF VEHICLES INVOLVED	MAJOR CAUSE OF ACCIDENT	CLASSIFICATION OF ACCIDENT AND BRIEF STATEMENT OF CIRCUMSTANCES
	A.M.	P.M.							
<u>Story</u>									#2 attempted to pass #1 - swung L. too far - hit curbing - lost control slid across the rd. & into the Rt. front of #1.
3-5-58	7:45		Snow	0	0	550	semi car	Passing	
<u>Adams</u>									#1 attempting to pass #2 - Struck curbing - lost control & over turned in ditch.
2-22-57		6:50	Snow	0	0	330	1 car	Passing	
<u>Adams</u>									#1 hit curbing on Rt. side of road - skidded & lost control - left roadway.
2-14-58	5:00		Snow	0	0	500	1 car	Hit Curbing	
<u>Audubon</u>									#1 attempted to pass #2 - #3 appeared from the opposite direction - #1 swerved Rt. to avoid #3 - hit curbing & shoulder & upset.
7-20-56		8:15	Dry	0	0	150	1 car	Dodging Vehicle	
<u>Henry</u>									#2 struck icy curb & skidded across highway into on coming #1.
2-16-56		2:30	Icy	0	1	1250	2 semi's	Skidding on Icy Curb	
<u>Henry</u>									#1 was forced into curb by unkown vehicle - skidded off the Rd. & rolled over.
12-19-56	6:30		Icy	0	0	1000	truck	Skidding on Icy Curb	
<u>Henry</u>									#1 hit curb & skidded - struck #2 parked in a farm lane.
1-13-57		2:45	Icy	0	0	650	2 cars	Skidding on Icy Curb	

18' PAVING WITH CURBING
ACCIDENTS FROM 1954 THRU 1958

Sheet 3 of 3

DATE	TIME		SURFACE CONDITION	FATALITIES	PERSONAL INJURIES	PROPERTY DAMAGE	TYPE OF VEHICLES INVOLVED	MAJOR CAUSE OF ACCIDENT	CLASSIFICATION OF ACCIDENT AND BRIEF STATEMENT OF CIRCUMSTANCES
	A.M.	P.M.							
<u>Davis</u>									#1 applied brakes as he approached a narrow bridge - car swerved hitting curb & shoulder
6-10-55		2:30	Dry	0	0	450	1 car	Narrow Bridge	#1 skidded across road & rolled over into the ditch.
<u>Davis</u>							Pickup		#2's Rt. rear wheels hitting curbing caused
9-18-56		12:15	Dry	0	0	203	Semi	Hit Curbing	#2 to skid across center line sideswipping on coming #1 on bridge.
<u>Davis</u>									#1 meeting on coming vehicle pulled to the
12-31-57	12:30		Icy	0	1	900	Semi	Hit Curbing	rt. - hit lip on curb causing his semi to jackknife.
<u>Clayton</u>									#1 came into curve at high rate of speed -
12-21-57		2:40	Dry	0	0	1740	1 car	Speed & Curb	ran up over the curb on the Rt. - lost control & left roadway - rolled twice.

18' PAVING WITH CURBING AND WITH FLUMES
ACCIDENTS FROM 1954 THRU 1958

Sheet 1 of 2

DATE	TIME		SURFACE CONDITION	FATALITIES	PERSONAL INJURIES	PROPERTY DAMAGE	TYPE OF VEHICLES INVOLVED	MAJOR CAUSE OF ACCIDENT	CLASSIFICATION OF ACCIDENT AND BRIEF STATEMENT OF CIRCUMSTANCES
	A.M.	P.M.							
<u>Story</u> 4-5-54		6:40	Wet	0	0	600	1 car	Passing	#1 was passing #2 - hit waterway - lost control & overturned in ditch.
<u>Story</u> 10-13-56		9:00	Wet	0	0	150	1 car	Hit Flume	#1 struck flume - spun around losing control of car - slid off the rd. backwards.
<u>Palo Alto</u> 2-7-54		5:40	Dry	0	1	1500	2 cars	Passing	#2 passed #3 - at same time #1 attempted to pass #2 - #1 hit the L. side of #2 & also struck a flume at same time - caused #1 to roll over into the ditch.
<u>Adams</u> 6-2-55		5:00	Dry	0	0	500	Trailer 1 car	Hit Spillway	#1 pulling trailer - trailer struck spillway causing #1 to lose control - ran over embankment.
<u>Audubon</u> 3-20-55	10:15		Icy	0	0	350	2 cars 1 truck	Hit Spillway	#2 pulled Rt. to avoid on coming #1 who was out of control - #2 struck a flume & skidded across the paving & into #1.
<u>Henry</u> 9-19-54		5:40	Dry	0	0	426	2 cars	Making Left Turn	#1 was passing #2 - #2 made a L. turn - #2 sideswiped #1 - #1 then hit a flume & this caused him to turn around in the roadway.
<u>Davis</u> 11-3-55	11:50		Dry	0	0	210	passenger bus car	Passing	#1 was passing #2 - #2 pulled slightly left to cross bridge - this crowded #1 into a flume - caused #1 to skid into L. side of #2 then #1 hit bridge.

18' PAVING WITH CURBING AND WITH FLUMES
ACCIDENTS FROM 1954 THRU 1958

Sheet 2 of 2

DATE	TIME		SURFACE CONDITION	FATALITIES	PERSONAL INJURIES	PROPERTY DAMAGE	TYPE OF VEHICLES INVOLVED	MAJOR CAUSE OF ACCIDENT	CLASSIFICATION OF ACCIDENT AND BRIEF STATEMENT OF CIRCUMSTANCES
	A.M.	P.M.							
<u>Davis</u> 2-26-56		4:05	Wet	0	1	805	1 car	Blow Out	#1's L. rear tire blew out causing him to lose control - hit flume on L. side of rd. then back across rd. in the rt. ditch.
<u>Davis</u> 3-22-58		10:00	Dry	0	0	103	2 cars	Hit Flume	#1 hit a spillway & this threw him across the center line & into the L. side of on coming #2.